CHAPTER 1
AN/TTC-39 Circuit Switch

1-1. Mission and Functions

The use of telephone switching equipment for Army tactical needs is constantly changing. The manual switchboards that once carried all telephone calls are giving way to automatic ones. The first automatic switchboards were large and cumbersome. The newer ones are far smaller and can be used at many levels of command. The first of these automatic switches were analog, yet because the Army is committed to digital communications, all future switches must have digital capability. However, they still must be able to work for some time with the existing analog equipment. The advantages of digital equipment include smaller size, faster operation, and greater efficiency. Digital systems are easier to reconfigure in time of emergency. They are also less vulnerable to noise than analog systems and are not degraded as much over long distances. Finally, they are simpler to multiplex and to encrypt.

The AN/TTC-39 circuit switch has brought digital electronics to tactical communications. It is a hybrid switch that combines analog and digital capabilities and is thus a bridge between the two. It is also modular. As more and more switching equipments and terminals become digital, the AN/TTC-39 can move toward an all digital function by changing its modules to increase its digital capacity. However, the switch introduces immediate benefits for the hybrid world, Combined with the AN/TYC-39 message switch, it reduces the need for and may eventually eliminate separate voice and data networks. It also combines the secure and nonsecure voice networks.

The Army's goal is to have a completely digital communications system. Such a system will have all its diverse elements, such as message systems, telephone systems, and mobile units, fully integrated. This means that each element can communicate with its related elements in the fastest, most secure, and most efficient way possible. The AN/TTC-39 circuit switch is one of the keys to reaching that goal. It is, as a result, the pivotal element around which most of the Army's communications system revolves. Chapter 2 describes a number of configurations for the AN/TTC-39. The Army intends to field both single and dual shelter versions of the AN/TTC-39 family of switches. However, the dual shelter, nominal 600-line version of the AN/TTC-39 is described since these may be used by other services at higher level headquarters and in joint usage.

The greatest use of the AN/TTC-39 is in the area switching systems in the theater and in the current corps. In both echelons, the circuit switches anchor a cohesive circuit switching network. Each switch is the center of a node that serves a group of subscribers (or users) and that provides tandem switching (switch-to-switch routing). Figure 1-1 shows an example of a theater circuit switching network. There can be up to twenty-four 300-line AN/TTC-39s in the theater area and up to twelve in each corps area. However, these maximums are guidelines and the actual number would depend on the need at the time. The AN/TTC-39s that serve the theater and the corps headquarters connect to this network. There can be three 600-line switches for the three theater headquarters and two 300-line switches for the two corps headquarters. Each of these headquarters has a displacement switch so that a maximum of AN/TTC-39s can be thirty in the theater area and sixteen in each corps area.

Figure 1-1 illustrates what is called the objective system. This is the term for the all-digital system of the future when enough digital equipment is in use to convert the entire communications system. This also involves changes to the communications concept of operations. By tradition and by need, tactical communications has involved two parallel systems. One was the common-user system, the other the command system. The latter ensured quick, efficient communications to the commanders and meant that the system had to be dedicated and discrete. The increased reliability and capabilities of the digital system make this dual arrangement obsolete and now there is a need for only one system. The AN/TTC-39 is able to handle all traffic without any unacceptable delays of the type that could occur in the older, dual system. The switching network of Figure 1-1 does not show the large number of other smaller circuit switches that are a part of it. These switches act as extension switches for local service. They may be digital or analog. The unit-level circuit switches AN/TTC-42 and SB-3865 are examples. The figure also does not

show the network's message switches (the AN/TYC-39). These generally reside at the AN/TTC-39 circuit switching nodes. The smaller switches, digital transmission and multiplex equipment, and other new equipment will be fielded over a long period of time. Because of this, the objective system will not be complete for several years.

For further information about corps and theater communications organizations and missions, see FM 11-50 and FM 11-92. Chapter 5 expands on this description of the AN/TTC-39's mission and functions. It also shows how to develop a system.

1-2. Communications-Electronics Management System

The introduction of automatic switches like the AN/TTC-39 has caused major changes in the Army's Communications-Electronics (CE) management policies and procedures. No longer can a commander operate his own communications in his own way. He must now concern himself with systems integration across all levels of the battlefield command. Requirements for higher capacity and for greater speed, security, dependability, and mobility have grown. This has led to an increased interdependence among all units. Good CE system management now requires centralized management joined with decentralized action. This means that the Army must change a number of its procedures. To this end, it has setup a standardized Communications-Electronics Management System (CEMS) as described in FM 24-22.

The CEMS exercises dynamic technical control over tactical CE systems and coordinates interfaces with other systems. Among its functions, it allocates resources, determines equipment status, sets levels of security access and subscriber precedence,

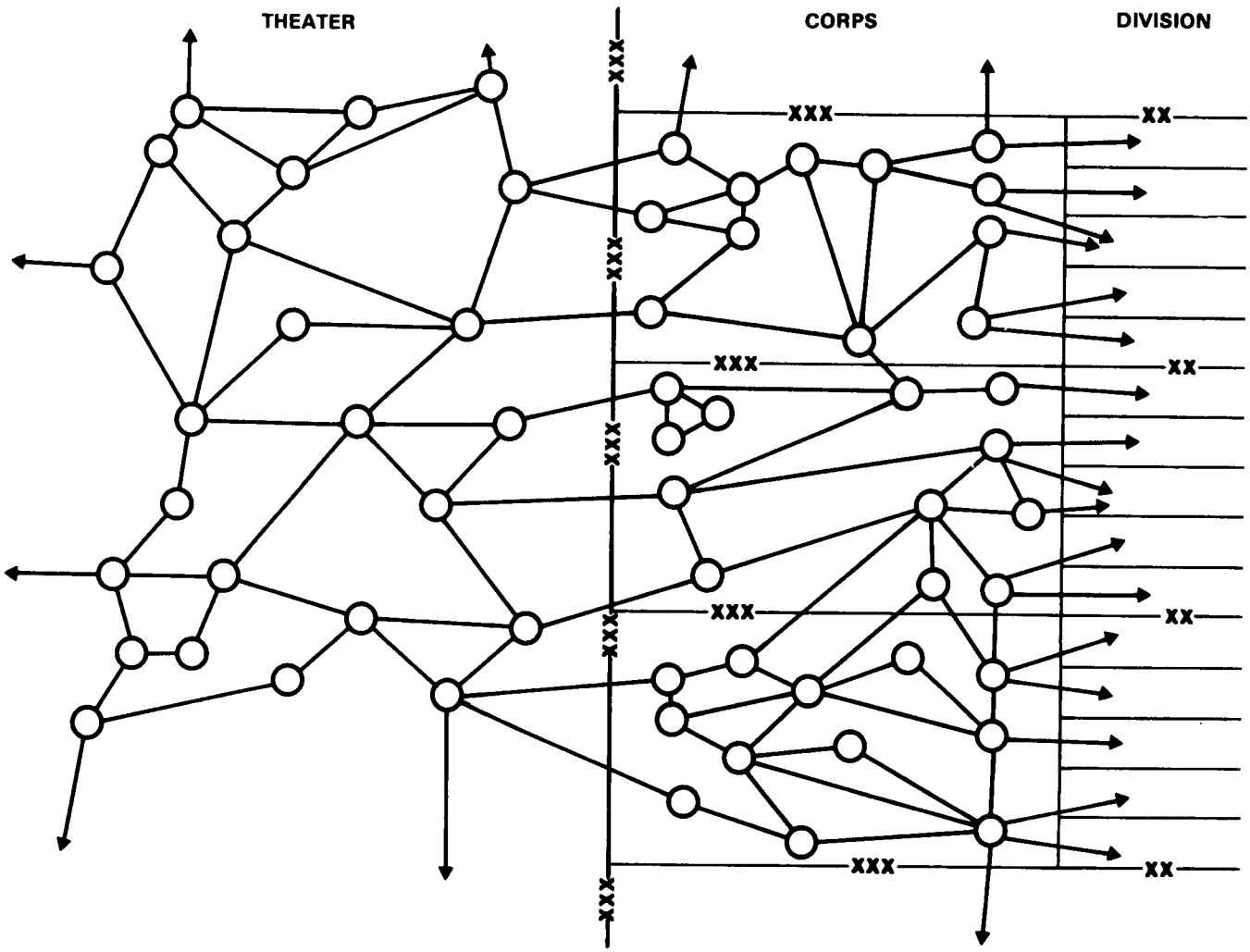

Figure 1-1. AN/TTC-39 networks in the theater.

and provides for equipment interfaces. It also handles all primary technical control functions that must be performed on a real-time or near real-time basis. These include monitoring, testing, failure prediction, restoring, and reporting. The CEMS functions with a complex mix of secure and nonsecure analog and digital CE equipments. The system will use automatic means to help analyze performance and to disseminate planning, engineering, and control information. The CEMS consists of four functional levels:

Communications systems planning element (CSPE).

This system element includes overall system planning, engineering, and management functions at the highest level. The theater signal brigade and the theater communications command (Army) (TCC(A)) have the responsibility for long-range planning, resources, and overall communications system management functions. At the corps level, the corps commander's CE staff coordinates with the corps signal brigade staff to do the CSPE work.

Communications system control element (CSCE).

This system element includes the systems control function for the network. It operates and controls the system on a real-time basis. Like the CSPE, the CSCE's functions are split among several organizational units at each of the echelons involved (for example, theater or corps). At the theater level, the CE staffs of the TCC(A) headquarters, of the theater signal brigade, and of the subordinate signal battalions carry out the CSCE functions. At the corps level, the staffs of the corps signal brigade and of the signal battalions perform them. The CSCE prepares and executes detailed orders that implement CSPE plans to deploy CE assets. It then takes overall technical control of the deployed resources and network operations. This includes all trunk and circuit routing and alternate routing for the entire network, generation of all subscriber information tables required by the nodal switches, and relocation of nodes.

Communications nodal control element (CNCE).

This system element includes the management and control functions of the local node. These functions take place at all of the major area nodes in the network. This includes switching, trunking, and subscriber activities at and around the node. It also includes certain testing functions on interconnecting trunks and recovery actions in response to failures, threat, or damage. The nodal control functions under the direction of the CSCE and it keeps the CSCE closely advised of the operational status of the subnet.

Communications equipment support element (CESE).

This system element includes the system status or performance measuring and reporting functions. Information from this function enables the control elements to run the network. It acts as the nerve endings of the control system providing feedback information. This function is, for the most part, currently done manually by personnel operating the various components of the system.

1-3. Information Flow

The previous description of the CEMS functions illustrates the changes in the information flow needed for automated networks. The use of the traditional chain-of-command hierarchy is no longer adequate for real-time control. Figure 1-2 summarizes the flow of information among the CEMS elements, Note that technical directives (or orders) may flow from the brigade CSPE/CSCE to both the battalion CSCE and to the node simultaneously. Status information flows to all levels but varies by type. To the brigade from the battalion the information is detailed but is sent by exception only. To the battalion and the brigade from the node the information is real time but is of the red/green (on/off) type. However, the battalion CSCE gets a constant flow of detailed status information.

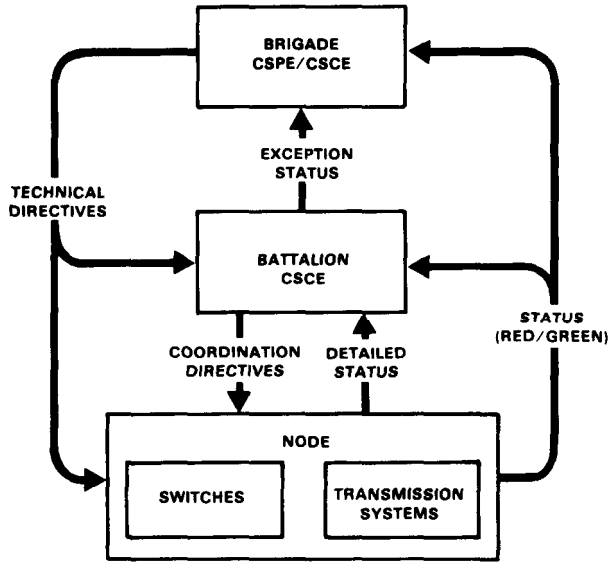

Figure 1-2. CEMS information flow.